

Before the  
Federal Communications Commission  
Washington, D.C. 20554

In the Matter of )  
 )  
 )  
The Establishment of Policies and ) IB Docket No. 02-19  
Service Rules for the Non-Geostationary )  
Satellite Orbit, Fixed Satellite Service in the )  
Ka-Band )

### REPORT AND ORDER

**Adopted:** June 18, 2003

**Released:** July 9, 2003

By the Commission:

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#### I. INTRODUCTION

1. This *Report and Order* decides the means for sharing among existing and prospective licensees in the non-geostationary satellite orbit, fixed satellite service (“NGSO FSS”) in certain Ka-Band frequencies.<sup>1</sup> The *Report and Order* determines the priority status of the one existing licensee from the first processing round of the Ka-Band NGSO FSS, Teledesic LLC, when it coordinates with operators licensed in this second processing round for the service. The *Report and Order* also adopts a technical

<sup>1</sup> Ka-Band frequencies at issue in this Order are between 18.8 and 19.3 GHz for space-to Earth (or “downlink”) communications and between 28.35 and 29.1 GHz for Earth-to-space (or “uplink”) communications.

definition to support the sharing method chosen, a default sharing mechanism, and addresses other necessary service rules. The policies and rules adopted in this *Report and Order* set out the sharing parameters for all Ka-Band NGSO FSS operations.

2. Existing and prospective licensees for Ka-Band NGSO FSS propose satellite-based Internet service and a variety of other data, video and telephony services, often through high speed or broadband communications channels. We expect that expanding the number of licensees offering these satellite services will provide additional competition for existing satellite and terrestrial service, thereby giving consumers additional choices when they purchase these services.

3. The Commission recently adopted a major revision of its space station licensing processes, to speed its action on applications for new systems and to adapt licensing processes employed since the early 1980s to the current satellite industry environment.<sup>2</sup> The *Space Station Reform Order* specifically noted the Ka-Band NGSO FSS applications pending in this proceeding, directing that licenses in this service be awarded pursuant to the processing mechanism adopted in this proceeding, rather than the band-splitting sharing mechanism that will generally be employed for spectrum sharing in future NGSO services.<sup>3</sup> The licenses granted in this Ka-Band NGSO FSS service will be subject, however, to a number of general satellite rules adopted in the *Space Station Reform Order*, including the removal of anti-trafficking restrictions, new system implementation milestones, and a system completion bond requirement.<sup>4</sup>

## II. BACKGROUND

4. Four companies have pending applications for Ka-Band NGSO FSS systems in this second processing round (the "Second Round"): Hughes Communications, Inc. ("Hughes"), @contact LLC ("@contact"), SkyBridge L.L.C. ("SkyBridge"), and TRW, Inc. ("TRW"). One company, Teledesic LLC ("Teledesic"), was licensed to provide Ka-Band NGSO FSS service in the first Ka-Band processing round (the "First Round"). These prospective operators of Ka-Band NGSO FSS systems collectively represent an opportunity for fixed satellite services to expand outside their operations in the more congested C- and Ku-band frequencies.

5. Commercial interest in Ka-Band technology was first sparked by the National Aeronautics and Space Administration's pioneering launch of its Advanced Communications Technology Satellite in 1993. Soon afterwards, Hughes filed an application for geostationary satellite orbit ("GSO") service in the Ka-Band. In 1994, Teledesic filed an application to launch a system of 840 NGSO satellites in the Ka-Band.<sup>5</sup>

6. Although the Ka-Band frequencies have so far been relatively unused for commercial satellite-based communications, these frequencies are also designated to and used by fixed terrestrial services and mobile services. The Commission has worked for more than a decade on various aspects of a band-segmentation plan that can accommodate all the terrestrial and satellite communication systems

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<sup>2</sup> *Amendment of the Commission's Space Station Licensing Rules and Policies and Mitigation of Orbital Debris*, First Report and Order and Further Notice of Proposed Rulemaking, IB Dockets No. 02-34 and 02-54, FCC 03-102 (released May 19, 2003) ("*Space Station Reform Order*").

<sup>3</sup> *Space Station Reform Order* at ¶ 280.

<sup>4</sup> *Id.* at ¶ 281.

<sup>5</sup> Teledesic was granted authority to reduce the number of satellites in its system to 288. *In The Matter Of Teledesic LLC For Minor Modification Of License To Construct, Launch And Operate A Non-Geostationary Fixed Satellite Service System*, 14 FCC Rcd 2261 (Int'l Bur. 1999). It has an application pending to reduce the number of satellites in its system to 30.

operating in the Ka-Band frequencies, including those at issue here.<sup>6</sup> In 1995, the Commission adopted a *Third Notice of Proposed Rulemaking* proposing a band plan for Ka-Band frequencies and requesting comment on service rules for Ka-Band satellite systems.<sup>7</sup> At the same time, the Commission issued a public notice describing five Ka-Band satellite applications received to that date, and setting a cut-off date for any further applications.<sup>8</sup> Although a number of parties filed additional applications for GSO FSS in the Ka-Band, the Commission received no other applications for NGSO FSS systems in the First Round. In March 1997, the International Bureau authorized Teledesic to construct, launch, and operate its proposed NGSO FSS system.<sup>9</sup>

7. In October 1997, the Commission adopted its *Third Report and Order* in the *Ka-Band Plan Proceeding*, setting forth technical requirements, licensing qualifications, and service rules for all GSO and NGSO FSS systems in the Ka-Band.<sup>10</sup> The Commission stated that it sought to foster competition by promoting multiple entry of NGSO FSS systems in the Ka-Band, but it deferred the determination of sharing principles should there be multiple NGSO systems in these frequencies.<sup>11</sup> At the same time, the Commission released a cut-off notice for applications, establishing the Second Round for Ka-Band NGSO FSS applications.<sup>12</sup> In response, six companies filed applications: Motorola Global Communications, Inc., @contact LLC, Hughes Communications, Inc., Lockheed Martin Corporation, SkyBridge II LLC, and TRW, Inc. Motorola's application proposed both GSO and NGSO satellites, but Motorola subsequently withdrew its application. Lockheed Martin also withdrew its application.

8. In February 2002, the Commission initiated this proceeding to determine the means by which multiple systems can share the Ka-Band spectrum designated for NGSO FSS operations.<sup>13</sup> The Commission proposed to license all pending Second Round applicants. The *Notice* described the available Ka-Band spectrum, and it identified NGSO FSS downlink (space to Earth) communications in

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<sup>6</sup> *Rulemaking to Amend Part 1 and Part 21 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band and to Establish Rules and Policies for Local Multipoint Distribution Service*, Notice of Proposed Rulemaking, Order, Tentative Decision and Order on Reconsideration, FCC No. 92-538, 8 FCC Rcd 557 (1993) (the "*Ka-Band Plan Proceeding*").

<sup>7</sup> *Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services*, Third Notice of Proposed Rulemaking, FCC No. 95-287, 11 FCC Rcd 53 (1995) ("*Third NPRM*").

<sup>8</sup> *Ka-Band Satellite Applications Accepted for Filing: Cut-off Established for Additional Applications*, Public Notice, Report No. SPB-20, DA 95-1689 (released July 28, 1995). This action commenced the First Ka-Band Processing Round.

<sup>9</sup> *Application of Teledesic Corporation for Authority to Construct, Launch, and Operate a Low Earth Orbit Satellite System in the Domestic and International Fixed Satellite Service*, Order and Authorization, DA 97-527, 12 FCC Rcd 3154 (Int'l Bur. 1997).

<sup>10</sup> *Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services*, Third Report and Order, FCC 97-378, 12 FCC Rcd 22310 (1997) ("*Third Report and Order*").

<sup>11</sup> *Third Report and Order*, 12 FCC Rcd at 22324.

<sup>12</sup> *Satellite Policy Branch Information: Satellite Application Accepted For Filing In The 18.8-19.3/28.6-29.1 and 19.7-20.2/29.5-30 GHz Bands, Cut-Off Established For Additional Applications In The 18.8-19.3 And 28.6-29.1 GHz Bands*, Public Notice, Report No. SPB-106, DA 97-2202 (released October 15, 1997).

<sup>13</sup> *The Establishment of Policies and Service Rules for the Non-Geostationary Satellite Orbit, Fixed-Satellite Service in the Ka-Band*, Notice of Proposed Rulemaking, FCC 02-30, 17 FCC Rcd 2807 (2002) (the "*Notice*").

the 18.8 to 19.3 GHz band, and NGSO FSS uplink (Earth to space) communications in the 28.6 to 29.1 GHz band on a primary basis. The downlink spectrum in the 18.8 to 19.3 GHz band is subject to requirements for relocating existing terrestrial fixed service operations grandfathered in those bands.<sup>14</sup> The Commission has also previously designated uplink communications in the 28.35 to 28.60 GHz band on a secondary basis.<sup>15</sup> The Commission sought comment on the best means to accommodate all of the applicants within the available Ka-Band spectrum, in light of Teledesic's First Round authorization. The *Notice* also sought comment on additional service rules for NGSO FSS licensees in the Ka-Band frequencies.

9. We note that United States Government GSO and NGSO FSS systems are authorized to operate in the 17.8-20.2 GHz frequency band in accordance with footnote US334 in the United States Table of Frequency Allocations, and that coordination between Government FSS systems and non-Government space and non-Government terrestrial systems will continue to remain in effect.<sup>16</sup> The means for sharing among existing and prospective non-Government Ka-Band NGSO FSS licensees decided in this *Report and Order* do not apply to sharing between those licensees and Government NGSO FSS systems. Nothing in this *Report and Order* is intended to change the relationship between Government and non-Government systems.

### III. DISCUSSION

#### A. Spectrum Sharing Options Considered

10. The Commission tentatively concluded in the *Notice* that the Ka-Band spectrum it has designated for NGSO FSS is sufficient to accommodate all licensed and proposed systems, including the First Round licensee and four Second Round applicants. Proceeding from that assumption, our choice among the sharing options considered will be guided by three principal objectives. First, our choice should be technologically neutral, not favoring any particular technology or operational method. Second, we seek to prevent spectrum warehousing by non-implemented NGSO FSS systems at the expense of operating systems. Third, the sharing option we choose should incorporate sufficient flexibility to promote and accommodate spectrum coordination among operating systems. An added consideration in choosing among sharing options is the effect that the choice might have on U.S.-licensed NGSO FSS systems' international operations, considering that other countries and regions have made differing spectrum management decisions. The *Notice* proposed the same four spectrum sharing options that were

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<sup>14</sup> *Redesignation of the 17.7-19.9 GHz Frequency Band, Blanket Licensing of Satellite Earth Stations in the 17.7-20.2 GHz and 27.5-30.0 GHz Frequency Bands, and the Allocation of Additional Spectrum in the 17.3-17.8 GHz and 24.75-25.25 GHz Frequency Bands for Broadcast Satellite-Service Use*, Report and Order, FCC 00-212, 15 FCC Rcd 13430, 13467 (2000); Second Order on Reconsideration, FCC 02-317, 17 FCC Rcd 24248, 24249 (2002).

<sup>15</sup> *Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services*, First Report and Order and Fourth Notice of Proposed Rulemaking, FCC 96-311, 11 FCC Rcd 19005, 19029 (1996). "Secondary" generally refers to a category of service with respect to other radio services. Stations of a secondary service shall not cause harmful interference to stations of primary or permitted services; cannot claim protection from harmful interference from stations of a primary or permitted service, but can claim protection from harmful interference from stations of the same or other secondary services to which frequencies are assigned at a later date. See *Third Report and Order*, 12 FCC Rcd at 22326; 47 C.F.R. § 2.104(d); 47 C.F.R. § 2.105(c)(3).

<sup>16</sup> See *Amendment of Part 2 of the Commission's Rules to Allocate Spectrum for the Fixed-Satellite Service in the 17.8-20.2 GHz Band for Government Use*, Memorandum Opinion and Order, FCC 95-316, 10 FCC Rcd 9931 (1995).

considered in the Ku-Band NGSO FSS proceeding:<sup>17</sup> (1) Flexible Band Segmentation; (2) Dynamic Band Segmentation; (3) Avoidance of In-Line Interference Events; and (4) Homogeneous Constellations.

11. The first two spectrum sharing options that the *Notice* proposed are both based upon segmenting the available Ka-Band spectrum between licensees. The first proposed option, named Flexible Band Segmentation, would segment the available spectrum at the time of licensing, so that the uplink and downlink spectrum would be divided into distinct spectrum segments of equal bandwidth, based on the number of authorized systems. Each NGSO FSS licensee would identify one set of spectrum segments at the time that the first satellite in its system reaches its intended orbit and initiates transmission and reception. Each licensee would then be required to notify the Commission of its identified segments. A combination of segments in the uplink and downlink directions would represent an operator's Selected Spectrum Assignment. The Commission would issue a Public Notice of each licensee's selection. Each NGSO FSS system would operate in its Selected Spectrum Assignment, and could also operate in any unoccupied Ka-Band spectrum designated for the NGSO FSS. When more than one NGSO FSS system becomes operational, NGSO FSS licensees would be required to coordinate the use of spectrum outside of their respective Selected Spectrum Assignments, subdividing the unoccupied spectrum equally, with the right of first selection determined by the date that the system commenced service.

12. The second proposed sharing option, named Dynamic Band Segmentation, would divide the available spectrum by the number of operational systems, rather than the number of licensed systems. Each time a new NGSO FSS system becomes operational by initiating transmission and reception at its intended orbit from the first satellite in its system, the other operational systems would be required to surrender spectrum to accommodate the new entrant.

13. The third proposed sharing option is named Avoidance of In-Line Interference Events. This sharing option would allow all NGSO FSS systems to share and operate throughout the designated Ka-Band spectrum so long as they avoid in-line interference events. An in-line interference event is an unintentional transmission in either direction between an Earth station of one system and a satellite of another caused by physical alignment. Absent an in-line interference event, NGSO FSS systems would have access to the entire Ka-Band spectrum designated for NGSO FSS use. Prior to the launch of its first satellite, each NGSO FSS operator would be required to complete coordination with all other operational NGSO FSS systems. In the *Notice*, the Commission recognized the need to establish a technical definition of in-line interference events, and proposed that they would be defined as the period of time during which 10 percent of the time allowance for the bit error rate specified in the short-term performance objectives of either network is exceeded.<sup>18</sup>

14. The fourth proposed sharing option is named Homogeneous Constellations, and is based upon the International Telecommunication Union's determination that multiple NGSO FSS systems can share the same frequency band without interference if they employ nearly identical orbital parameters. The Commission would choose a single homogeneous constellation design and assign an equivalent amount of the available spectrum to each applicant. Each NGSO FSS licensee would be required to deploy its system within a defined envelope of orbital and transmission parameters comprising an identified constellation design, and would share its spectrum assignment with other systems of like design.

<sup>17</sup> See *Establishment of Policies and Service Rules for the Non-Geostationary Satellite Orbit, Fixed Satellite Service in the Ku-Band*, Notice of Proposed Rulemaking, FCC 01-134, 16 FCC Rcd 9680 (2001) ("Ku-Band NGSO FSS Notice"); Report and Order and Further Notice of Proposed Rulemaking, FCC 02-123, 17 FCC Rcd 7841 (2002) ("Ku-Band NGSO FSS Report & Order").

<sup>18</sup> *Notice*, 17 FCC Rcd at 2817.

15. Comments from Second Round applicants proposed two variations on these options. The Commission described in the *Notice* a sharing proposal by @contact, under which Second Round licenses would be awarded based on Flexible Band Segmentation, but coordination between Second Round licensees and Teledesic would be deferred until after Second Round licensing.<sup>19</sup> In its comments on the *Notice*, TRW proposed a variation on the third option, Avoidance of In-Line Interference Events, which overlaid one aspect of the Homogeneous Constellations option, by asking the Commission to establish uniform system parameters.<sup>20</sup>

16. We received comments from Teledesic and from the four remaining Second Round applicants.<sup>21</sup> Although only one commenter initially expressed support for the band segmentation options, that party, @contact, later decided to support the Avoidance of In-Line Interference Events option instead.<sup>22</sup> The other comments on the band segmentation options generally expressed concern that the amount of bandwidth available under either Flexible Band Segmentation or Dynamic Band Segmentation would not be sufficient for an economically viable system. Hughes noted that Flexible Band Segmentation limits the capacity of the system and the number of users that can be served.<sup>23</sup> Hughes also stated that Dynamic Band Segmentation, while it provides early systems with more capacity than they would receive under Flexible Band Segmentation, does not grow as markets do over time.<sup>24</sup> TRW stated that either band segmentation option would require that systems use less spectrum over time as their user base is growing.<sup>25</sup> TRW expressed its belief that the consequence is that later entering systems would have leverage over earlier systems as they begin coordination to put their systems into operation. SkyBridge also expressed concern over coordination problems, in that any system given rights to home spectrum would have no incentive to share its exclusive spectrum.<sup>26</sup> Teledesic feared that band segmentation options would give Second Round licensees a right to "evict" Teledesic from spectrum to which it was licensed in the First Round.<sup>27</sup>

17. In the only comments favoring the Homogeneous Constellations sharing option, Hughes stated that this option would produce acceptable interference levels with less complex operational procedures.<sup>28</sup> According to Hughes, all systems would employ similar power levels and would have access to the entire 500 megahertz of spectrum available to Ka-Band NGSO FSS systems in each direction, uplink and downlink.<sup>29</sup> Other comments on the Homogeneous Constellations sharing option were sharply opposed to the option, however, primarily because it is not neutral with regard to the

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<sup>19</sup> *Notice*, 17 FCC Rcd at 2815.

<sup>20</sup> Comments of TRW, Inc. (filed April 3, 2002) ("TRW Comments") at 4.

<sup>21</sup> Comments of @contact LLC ("@contact Comments"), Comments of Hughes Communications, Inc. ("Hughes Comments"), Comments of SkyBridge ("SkyBridge Comments"), Comments of Teledesic LLC ("Teledesic Comments") and Comments of TRW Inc. ("TRW Comments") (all filed April 3, 2002). The same five parties filed reply comments on April 18, 2002 (respectively, the "@contact Reply," "Hughes Reply," "SkyBridge Reply," "Teledesic Reply," and "TRW Reply").

<sup>22</sup> @contact LLC Notice of *Ex Parte* Presentation in IB Docket No. 02-19 (filed May 13, 2002).

<sup>23</sup> Hughes Comments at 3.

<sup>24</sup> Hughes Comments at 4.

<sup>25</sup> TRW Comments at 11.

<sup>26</sup> SkyBridge Comments at 6.

<sup>27</sup> Teledesic Comments at 6-7.

<sup>28</sup> Hughes Comments at 7.

<sup>29</sup> Hughes Comments at 9.

technology employed.<sup>30</sup> @contact asserted that the option would limit systems' design and operational flexibility.<sup>31</sup> Teledesic opposed the Homogeneous Constellations sharing option because it would favor one technical approach over others, contrary to the Commission's stated goal of allowing the market to determine the most effective implementation of NGSO FSS systems.<sup>32</sup> TRW stated that there is no clear set of standards in the Second Round that can provide a template for a homogeneous constellation design.<sup>33</sup> TRW nevertheless prefers that the Commission take steps to encourage homogeneity by imposing key parameters.<sup>34</sup> Finally, in response to a concern raised in the *Notice*, SkyBridge stated that U.S.-licensed systems of a homogeneous design might be obligated to share with foreign systems that do not have the same design, jeopardizing their global operations.<sup>35</sup>

## B. Spectrum-Sharing Plan Chosen

18. Our objectives in choosing among the proposed sharing options are to choose a technologically neutral option, to avoid spectrum warehousing, and to encourage system flexibility to promote spectrum coordination. These are essentially the same objectives pursued in the choice of a sharing method for NGSO FSS systems in the Ku-Band, where the Commission proposed the same four sharing options.<sup>36</sup> While there are differences in the physical characteristics and inter-service sharing constraints between the Ka- and Ku- frequency bands, the system operations of the two services will be quite similar. The adoption of similar sharing rules for the two services is therefore operationally appropriate and offers the benefit of administrative efficiency and may enhance the development of technology applicable to both services. As we decided in the case of NGSO FSS systems in the Ku-Band, we again find that the Avoidance of In-Line Interference Events spectrum sharing method best meets all of our objectives. We therefore adopt this proposal as the basis of our Ka-Band NGSO FSS sharing rules.

19. Under optimal circumstances when using the adopted spectrum sharing method, all Ka-Band NGSO FSS licensees will be allowed to operate throughout the spectrum designated for this service. Operating conditions will be less than optimal when Earth stations and space stations of different systems move into an alignment that creates an in-line interference event. As the Commission noted in the *Ku-Band NGSO FSS Report & Order*, at the present early stage of system design and development, there is no certain measure of the percentage of time when systems will have access to the entire spectrum versus the amount of time when they will be required to mitigate in-line interference events. Based upon the best estimates in the records in both proceedings, however, we anticipate that NGSO FSS licensees will have the freedom to operate in the entire designated spectrum for 90% or more of the possible operating time.

20. The Avoidance of In-Line Interference Events sharing method we adopt today provides necessary regulatory direction while allowing market forces to direct the course of this new service. So long as NGSO FSS operators avoid causing in-line interference events between systems, they are free to design any constellation and any service offerings best suited for their business plans and the markets they seek to serve. This serves our technological neutrality objective. The Avoidance of In-Line Interference Events also accomplishes our second objective, which is to avoid spectrum warehousing. Warehousing

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<sup>30</sup> See, e.g., SkyBridge Comments at 9.

<sup>31</sup> @contact Comments at 18.

<sup>32</sup> Teledesic Comments at 14.

<sup>33</sup> TRW Comments at 13.

<sup>34</sup> *Id.* at 14.

<sup>35</sup> SkyBridge Comments at 10.

<sup>36</sup> *Ku-Band NGSO FSS Notice*, 16 FCC Rcd at 9687.

can hinder the availability of services to the public at the earliest possible date, when one system is able to block entry by other entities willing and able to proceed immediately with the construction and launch of their satellite systems.<sup>37</sup> In this service, however, because all licensees will be free to operate throughout the spectrum, no licensee will have the ability to impede the operations of other licensees. Our third objective is met as well, for we believe that the technical criteria we adopt for this service incorporate sufficient flexibility to promote coordination among all operating Ka-Band NGSO FSS systems. Beyond the minimum availability that is guaranteed by the default method described herein, these rules provide incentive and opportunity for operating systems to coordinate among themselves to improve their operating capacity. If they do so, they can increase the amount of time when they can operate freely throughout the designated spectrum, thus increasing their system capacity. Prior to the launch of its first satellite, each NGSO FSS licensee will also be required to complete coordination with all other operational NGSO FSS licensees and with Government FSS systems.

21. We are not persuaded of the merit in either variation on sharing options proposed by Second Round applicants.<sup>38</sup> First, we note that @contact has revised its comments to support the Avoidance of In-Line Interference Events option, withdrawing its variation on the band segmentation options.<sup>39</sup> TRW proposed adoption of the Avoidance of In-Line Interference Events sharing option, but it asks the Commission to establish and impose uniform system parameters.<sup>40</sup> Because one of our primary goals in choosing among the sharing options is technological neutrality, we will not impose uniform system parameters. Although we are open to allowing uniform system parameters where the licensees agree to uniformity for their own reasons, we will not impose uniformity by regulation. We find that all our stated objectives are best met by the Avoidance of In-line Interference Events sharing method, and we therefore adopt it as the basis of our Ka-Band NGSO FSS sharing rules.

### C. Teledesic Coordination Priority

22. In the *Notice*, the Commission sought comment on issues of spectrum sharing and coordination between prospective Second Round NGSO FSS licensees and Teledesic, which was the sole NGSO licensee in the First Round.<sup>41</sup> When it adopted its *Third Report and Order*, the Commission stated that it expected all non-Government NGSO FSS systems to be responsible for some portion of the burden of inter-system sharing.<sup>42</sup> The *Third Report and Order* also advised that the Commission would recognize system design changes proposed by licensees as a sign that a licensee seeking authority for design changes could accommodate sharing with other systems. In a petition for reconsideration of the *Third Report and Order*, Teledesic asked the Commission to clarify the relationship between licensees in one round and applicants in later processing rounds. The Commission's *Teledesic Reconsideration Order* determined that licensees who had made progress in implementing their systems would not have to significantly alter their systems to accommodate later applicants.<sup>43</sup> If, on the other hand, a licensee such

<sup>37</sup> *First Columbia Milestone Order*, 15 FCC Rcd 15566, 15571 (2000).

<sup>38</sup> See ¶ 15, above.

<sup>39</sup> @contact LLC Notice of *Ex Parte* Presentation in IB Docket No. 02-19 (filed May 13, 2002).

<sup>40</sup> Uniform system parameters would consist of some combination of identical orbital characteristics. For example, we could require all systems to design low-Earth orbit systems so that their satellites travel in harmonized orbits without risk of collision or harmful interference. In its reply comments, TRW asserts its belief that some harmonization of system parameters will occur due to technical and market realities facing the proposed operators. TRW Reply at 4.

<sup>41</sup> *Notice*, 17 FCC Rcd at 2812.

<sup>42</sup> *Third Report and Order*, 12 FCC Rcd at 22324.

<sup>43</sup> *Teledesic Corporation Petition For Clarification And/Or Reconsideration Rulemaking to Amend Parts 1, 2, 21 and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the* (continued....)

as Teledesic significantly modified its system parameters, its progress in implementing its system would not be impeded by modifications made necessary by sharing with new entrants.

23. Teledesic did in fact seek a significant modification of its system in a February 2002 application filed just days after the Commission adopted the *Notice* in this proceeding.<sup>44</sup> Teledesic proposed to make numerous design changes to its system, including decreasing the number and inclination of its orbital planes, and decreasing the number of proposed satellites from 288 to 30. Teledesic also proposed to change the orbital altitude of its system, from the low-Earth orbit authorized in its license to a medium-Earth orbit. The merits of Teledesic's modification application will be addressed by the International Bureau in a separate licensing proceeding.

24. As presaged by the Commission's decision in the *Teledesic Reconsideration Order*, Teledesic's modification application has a direct impact on coordination and sharing methods considered in this proceeding as well. Teledesic maintains that its modification application is an entirely separate proceeding, and asserts that it retains First Round coordination priority over all systems licensed in the Second Round as a matter of law.<sup>45</sup> The Second Round applicants, on the contrary, are united in the view that as a result of its proposed modification, Teledesic is no longer entitled to coordination priority over Second Round licensees.<sup>46</sup> In its Reply to them, Teledesic counters that the other comments fail to distinguish between coordination priority and coordination outcomes.<sup>47</sup> Teledesic states that coordination priority dictates which party is responsible for initiating coordination discussions. Teledesic asserts that requiring each new entrant to request coordination from each incumbent operator is the traditional approach.

25. We find that our traditional approach to coordination is indeed to require new entrants to request coordination from incumbent operators, but we also find that this approach provides no guidance in this situation, because there is no incumbent operator with an operating system. Although Teledesic was licensed in 1997, it still does not have a single satellite in orbit. As the only First Round licensee, Teledesic would have had priority over new Second Round entrants as an incumbent operator if it were operating its system. The fact that it is not yet operating is the first indication that its system has flexibility to adapt to accommodate new entrants.<sup>48</sup> The adaptability of Teledesic's system is further proven by its latest modification application. The International Bureau has already granted one request from Teledesic to modify its system, transforming a constellation of 840 satellites in 21 NGSO orbital planes to a system consisting of 288 satellites in 12 orbital planes.<sup>49</sup> The pending modification

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29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and For Fixed Satellite Services, Memorandum Opinion and Order, FCC 02-6, 17 FCC Rcd 2489 (2002) ("*Teledesic Reconsideration Order*").

<sup>44</sup> Teledesic LLC, Application to Modify Authorization to Launch and Operate a Non-Geostationary Fixed-Satellite System, SAT-MOD-20020201; Public Notice Report No. SAT-00100 (February 14, 2002).

<sup>45</sup> Teledesic Reply at 3. While Teledesic argues that the Commission grant of a license to it as the sole First Round licensee grants it coordination priority over second round systems as a "matter of law," the law at issue is a Commission licensing decision that can be amended or revised by the Commission.

<sup>46</sup> TRW Comments at 3; @contact Comments at 4; Hughes Comments at 15; SkyBridge Comments at 3.

<sup>47</sup> Teledesic Reply at 3.

<sup>48</sup> See Teledesic LLC News Release, "Teledesic Suspends Work Under Satellite Contract" (September 30, 2002), <http://www.teledesic.com/newsroom/articles/10-01-2002.html>.

<sup>49</sup> *In the Matter of Teledesic LLC, for Minor Modification of License to Construct, Launch and Operate a Non-Geostationary Fixed Satellite Service System*, Order and Authorization, DA 99-267, 14 FCC Rcd 2261 (Int'l Bur. 1999).

application proposes a system of 30 satellites, and proposes to change the system's altitude from low-Earth orbit to medium-Earth orbit. Commission policy has generally been to allow satellite licensees to modify their systems as they deem necessary to meet changes in technology or market demands, provided they meet their system implementation milestones. At the same time, we believe that a satellite system with a continually evolving system design is manifestly able to redesign to accommodate intra-service coordination.

26. In any case, we note that Teledesic's proposed modification may simplify coordination in the band because, other things being equal, NGSO licensees can more easily coordinate with an NGSO constellation that has 30 satellites instead of 288. The reduced level of complex coordination in this band further limits the need to develop and maintain an intricate set of inter-system coordination priorities among operators in this band.

27. We therefore find that Teledesic must share the burden of coordination equally with Second Round licensees. All operating systems will have access to the entire available Ka-Band spectrum except during in-line interference events. As explained in the discussion of implementation, below, whenever two NGSO FSS systems are coordinating to avoid an in-line interference event, the default mechanism is that they will split the available spectrum for the duration of the event. Traditional Commission practice will be implemented in this coordination, as well, because prior to the launch of its first satellite, each NGSO FSS licensee must complete coordination with all other operational NGSO FSS licensees and with Government FSS systems, including a choice of "home base" spectrum when the default mechanism is needed. In these coordinations, the first launched and fully operating system has the choice of which half of the available spectrum will be its home base for the duration of in-line interference events with the other system. But as there is no difference in quantity or kind between the halves of the spectrum, this first choice, a kind of coordination priority, has little significance.

28. Our decision on Teledesic's coordination priority is equitable and advances the public interest. Under its system implementation milestones, Teledesic should be in the process of constructing its first two satellites, which must be complete by January 2004.<sup>50</sup> It is not required to commence construction of its remaining satellites until January 2004. Teledesic therefore has the remainder of this year to incorporate any design changes that could be required by coordination into the two satellites that should be under construction, and should be able to incorporate any necessary changes into the design of its remaining satellites before construction on them commences. Having made such significant revisions to its satellite system since receiving its license, Teledesic is unlikely to suffer any prejudice from its loss of coordination priority over Second Round licensees. We also believe that adopting and enforcing a coordination priority for Teledesic would unfairly prejudice the Second Round licensees. In any event, it remains the case that whichever system launches first and is fully operational will establish priority. We believe this approach provides the proper incentive to bring spectrum into use while adequately protecting all systems from interference.

#### **D. Implementing Avoidance of In-Line Interference Events**

29. The Avoidance of In-Line Interference Events method that we adopt for spectrum sharing among NGSO FSS systems in the Ka-Band frequencies is the same sharing method that the Commission adopted last year for use among NGSO FSS systems in the Ku-Band frequencies.<sup>51</sup> Given the strong similarities between Ku- and Ka-band NGSO FSS system characteristics that we have previously noted, our choices for implementing Avoidance of In-Line Interference Events in the Ka-band are informed by the Commission's decision in the Ku-Band NGSO FSS proceeding as well as the record in this

<sup>50</sup> *Teledesic LLC Application for Authority to Construct, Launch and Operate a Ka-band Satellite System in the Fixed-Satellite Service*, Order and Authorization, DA 01-229, 16 FCC Rcd 2501 (Int'l Bur. 2001).

<sup>51</sup> *Ku-Band NGSO FSS Report & Order*, 17 FCC Rcd at 7854.

proceeding. Indeed, half the applicants in this proceeding are also Ku-Band applicants, and other Ka-Band applicants also filed comments in that proceeding.

30. The core decisions necessary to implement the avoidance of in-line interference technique among NGSO FSS systems are the definition of an in-line interference event, and a baseline default sharing mechanism that allows continuous operation of NGSO FSS systems even when intra-system coordination fails for any reason. In the Ku-Band NGSO FSS proceeding, the Commission adopted a definition of in-line interference events based on an angle of separation between satellites approaching perfect alignment with a given Earth station. We decide today to adopt the same angular separation definition of in-line events in this Ka-Band NGSO FSS proceeding.

## 1. Defining In-Line Interference Events

### a. Definitions Considered

31. In the *Notice*, the Commission stated the need to establish an unambiguous technical definition of in-line interference parameters should it choose avoidance of in-line interference as the method for intra-service sharing among NGSO FSS licensees.<sup>52</sup> The *Notice* discussed using the change in total system noise power, a definition also proposed in the Ku-Band NGSO FSS proceeding, but noted concern that this long-term interference criterion might not be appropriate in the short-term situations that characterize NGSO interference. The *Notice* then proposed to define in-line interference events by the bit error rate ("BER") time allowance method.<sup>53</sup> The comments and reply comments on the *Notice* discussed these two definitions and also proposed the angular separation method since adopted by the Commission in the Ku-Band NGSO FSS proceeding.

32. The comments are unanimous in rejecting a definition based on the change in total system noise power. We are persuaded by the comments that the physical differences of NGSO systems render that measurement – which is successfully used in a geostationary satellite orbit environment – unfit for this purpose. We will therefore reject its use as a measure of in-line interference. We focus instead on the choice between angular separation and bit error rate time allowance.

33. Teledesic proposed that an in-line interference event be defined by an aggregate interference time allowance of 10 percent of the time allowance for the BER specified in the short-term performance objectives of the system. This proposal is based on recommendations developed in recent International Telecommunication Union Radiocommunication Sector ("ITU-R") working party studies on aggregate interference.<sup>54</sup> Teledesic also proposed a means by which the BER time allowance can be modified to address NGSO FSS systems that require heavier coding to compensate for rain fading,<sup>55</sup> and proposes means to apportion intra-service in-line interference generated by multiple systems.<sup>56</sup> SkyBridge commented that short-term performance objectives could be based on a time allowance for BER, but stated that Teledesic's proposed method, while perhaps more accurate, is far too complex for a default coordination solution.<sup>57</sup>

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<sup>52</sup> *Notice*, 17 FCC Rcd at 2817.

<sup>53</sup> *Notice*, 17 FCC Rcd at 2817. The bit error rate time allowance definition favored by Teledesic was introduced by Teledesic comments in the Ku-Band proceeding. Teledesic LLC Comments on *Ku-Band NGSO FSS Notice*, IB Docket No. 01-96 (filed July 5, 2001).

<sup>54</sup> Teledesic Reply at 9-11.

<sup>55</sup> Teledesic Comments at 21.

<sup>56</sup> Teledesic Comments at 22.

<sup>57</sup> SkyBridge Reply at 15.

34. In its comments in this proceeding, SkyBridge refers to its detailed discussion of implementing avoidance of in-line interference events in the Ku-Band NGSO FSS proceeding, where it proposed defining the event as an Earth-based separation angle of 10 degrees between NGSO FSS satellites.<sup>58</sup> In this proceeding, SkyBridge proposes that the angle of separation definition be modified to take into account higher power systems. SkyBridge also proposes, for consideration in this proceeding, what it terms "more rigorous" approaches to defining in-line interference events, which could use synchronization loss in communications links as the basis for the choice of an optimum angle of separation.<sup>59</sup> Teledesic disagrees with SkyBridge's assertion that the latter's synchronization loss definition is less complicated, but agrees that a satisfactory definition could be crafted using either approach.<sup>60</sup> TRW also joins SkyBridge in proposing to define in-line interference events in terms of angular separation between two satellites of different systems as viewed by an earth station antenna.<sup>61</sup> TRW proposes a five-degree angle of separation.<sup>62</sup>

**b. Definition Adopted**

35. When the Commission adopted the *Notice* in this proceeding in February 2002, it proposed to adopt the BER time allowance method to define in-line interference events among Ka-Band NGSO FSS systems. The Commission subsequently considered the record on this same issue in the Ku-Band NGSO FSS proceeding, where it decided to adopt a 10-degree angle of separation as the definition of an in-line event in that very similar service.<sup>63</sup> Based on that decision and the record in this Ka-Band NGSO FSS proceeding, we again adopt the 10-degree angle of separation as the definition of an in-line interference event.

36. As the Commission did in the decision on NGSO FSS systems in the Ku-Band, we emphasize again that the definition of an in-line interference event that we adopt for regulatory purposes in no way prevents satellite operators from using the BER time allowance definition or any other definition in coordinations aimed at achieving more efficient or optimum results between themselves. Coordination between systems to avoid events can use any or all of the proposed definitions to define more precisely the occurrence of in-line interference events between the coordinating systems. By defining more precisely the events between them, systems can increase the amount of time each system is able to operate in the entire available spectrum. In order for the Commission to administer NGSO FSS sharing in the same frequencies, however, we must adopt a baseline definition of an in-line interference event that is used as the standard to define the entire set of in-line interference events between two systems and to dictate when the fallback or default method of operation is used whenever coordination fails for any reason.

37. Our goal is to adopt a clear and enforceable standard that is easily understood by all parties. We therefore adopt an Earth-surface based (topocentric) angular separation standard to define an in-line interference event. We do not adopt the BER time allowance definition. The commenters that addressed the issue of defining in-line interference events agree that the BER time allowance method is perhaps the most accurate method for defining in-line interference events. We find no reason to disagree with that

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<sup>58</sup> SkyBridge Comments at 13.

<sup>59</sup> SkyBridge Comments at 14.

<sup>60</sup> Teledesic Reply at 11.

<sup>61</sup> TRW Comments at 5.

<sup>62</sup> TRW Comments at 6.

<sup>63</sup> *Ku-Band NGSO FSS Report & Order*, 17 FCC Rcd at 7854. Teledesic later filed a petition in which it asked the Commission to reconsider the definition adopted in the Ku-Band proceeding. We will address the arguments raised in that petition in a separate decision in the Ku-Band proceeding.

assessment, but we nevertheless find that the method is unsuited for the regulatory purpose at hand because it is simply too complex for either the parties or the Commission to administer on a routine basis and generates few, if any, corresponding public interest benefits.<sup>64</sup> While in-line interference events will occur in a small number of the annual operating hours of these systems, they will indeed occur, regularly and repetitively. This predictability of in-line interference events allows systems to plan mitigation efforts to avoid interference in a manageable manner. But the sheer number of these recurring events requires that the Commission be able to regulate this sharing methodology without having to regularly intervene in the coordination process.

38. In this case, adopting an accurate, reliable and easily administered definition of in-line interference will better serve the public interest than a definition that, while potentially technically more accurate, requires costly, time-consuming analysis from all the parties involved. A single fixed angle of separation will allow a simple, objective identification of the universe of in-line interference events between any two systems. In order for systems to predict where in-line interference events will occur, NGSO FSS systems must exchange ephemeris data on a frequent basis to identify space stations and their movement. We have already required this of the Ku-Band systems,<sup>65</sup> and will also require it of the Ka-Band systems. Coordinating systems will then exchange the geographic location of their fixed Earth stations. Each licensee will enter the ephemeris data on space stations, the geographic coordinates of Earth stations, and a 10° angle of separation as inputs in basic software simulation that can quickly identify each and every in-line interference event between the systems entered. Unlike the BER methodology, the single fixed-angle approach provides little or no room for disagreement over where in-line interference events occur.

39. Our choice of angular separation to define in-line interference events also allows simple regulation of what the licensees must do when events occur, and how long they must do it. The default sharing mechanism that we adopt below requires licensees to split the assigned uplink and downlink spectrum equally between them for the duration of their satellites' passage through a 10° angle of separation. This method therefore also defines the minimum amount of time for which licensees can assume they will have unhindered operation. Licensees will have full use of the Ka-Band NGSO FSS spectrum at all times except when satellites are within the 10° angle, and they will have use of half the Ka-Band NGSO FSS spectrum during those events for the individually affected space stations.<sup>66</sup> We allow and encourage – but do not require -- licensees to coordinate between and among themselves to further optimize the amount of operating time in which they avoid in-line interference events, often by defining a smaller angle of separation.

40. We note that studies conducted by Teledesic, with results filed in the record, indicate that the applicants in this proceeding can expect to operate at least 94% of the time with one or more satellites unconstrained by mitigation measures taken to avoid in-line interference events.<sup>67</sup> We appreciate that some satellite service business models require higher percentages of time for unconstrained operation. We provide the means and the incentive for systems to achieve those improved operations, but will not involve the Commission in compelling that result. In keeping with our overall goals in the choice among sharing options, we seek to avoid promoting any particular technological solution. There are a number of

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<sup>64</sup> But see ¶ 41, *infra*, for discussion of regulatory limitations of the BER method.

<sup>65</sup> 47 C.F.R. § 25.271(e).

<sup>66</sup> This assumes two systems are involved in the in-line interference event. Where three systems are involved, each system would be required to split the available uplink and downlink spectrum into thirds. Comments filed in the Ku-Band NGSO FSS proceeding predicted that as a matter of statistical probability based on independently moving satellite constellations, the vast majority of in-line interference events will involve only two systems. *Ku-Band NGSO FSS Report and Order*, 17 FCC Rcd at 7852.

<sup>67</sup> Teledesic *Ex Parte* Notice at 7-8 (filed June 25, 2002).

system design options that applicants can choose to employ if they seek to minimize or even eliminate the times when their system will be the victim of an in-line interference event. On the other hand, applicants that value economy over what might be a more expensive technological solution may choose to reach for more optimum sharing through coordination with other systems, or may simply choose a business model that works in the minimum amount of operating time and spectrum guaranteed by the default sharing method.

41. We do not adopt the BER time allowance definition of in-line interference events because it is overly complicated for use in defining baseline operation. First, as noted above, the angular separation method allows three inputs in a software simulation to define simply where in-line interference events occur between two systems. In the BER time allowance rule Teledesic proposed in this proceeding, discussions between two systems can break down at their inception over the threshold question of where events occur. The systems must conduct their respective time-consuming evaluations of the precise angle of separation necessary to protect their systems vis a vis the other system, and then must agree on the avoidance angles to be used in order to agree on the universe of in-line events.<sup>68</sup> Teledesic proposes that the systems work on this for as much as four months, then resort to binding arbitration if they cannot agree on where events occur. Second, if the systems do agree, or after arbitration, the systems then coordinate on mitigation methods to use when in-line interference events occur. Third, failing successful results from mitigation discussions, Teledesic proposes that the systems resort to the default sharing method we adopt, which is to split the available operating spectrum. Use of the BER time allowance definition also requires further definition when more than two systems are operating, with the time allowance adjusted to smaller percentages as new systems become operational.

42. SkyBridge and Teledesic agree that either the BER time allowance or some measurement of link synchronization loss would most accurately define the precise angle of separation necessary to protect the operations of every respective pair of operating systems. Although we encourage all systems to employ either of these measures to optimize their operating efficiency, we find that the BER time allowance method is overly complicated for use in defining in-line interference events for purposes of our regulations. In addition, it also creates too much potential for inter-system impasse that the Commission may be called upon to resolve.

43. Instead, we adopt a definition of in-line interference events that is based on a 10-degree-avoidance angle between satellites of different networks. The choice of a specific degree of angular separation requires a balancing of technical goals. Larger angles may be required to limit interference between systems that either are very susceptible to interference or are more likely to cause it. On the other hand, if the angle is too large, the efficiency of the orbit is greatly reduced, as there will be an increase in the percentage of time that satellite operations are restricted. We note that in its filings, Teledesic included an evaluation of the avoidance angles required to ensure optimum protection of all the applicants in this proceeding at the level that would be prescribed by using the BER time allowance method of definition.<sup>69</sup> Out of 30 possible combinations of applicant systems, just 5 of the combinations require an angle of separation greater than 10 degrees. Based upon the information in this proceeding, and comparable information on differing system designs in the Ku-Band proceeding, we set the baseline definition at a 10-degree angle of separation to reduce the impact on systems that may be more susceptible to interference while not overly constraining others. Although our preliminary analysis of the characteristics of Ka-Band transmissions indicates that an angle of separation even less than 10 degrees could provide ample separation in these frequencies, as compared to what is necessary for Ku-Band transmissions, there is little technical support in this record for that proposition. We therefore choose a baseline 10-degree angle of separation. If experience upon implementation leads to proof that a smaller

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<sup>68</sup> Teledesic Reply at 14.

<sup>69</sup> Teledesic *Ex Parte* Notice at 5 (filed June 25, 2002).

angle can provide ample separation in the Ka-Band, we may revisit this angle of separation. We expect system transmitter designers to take the 10-degree angle of separation into account as they balance the Earth station antenna diameters and input power levels in their systems.

## 2. Default Sharing Mechanism

44. There are at least two possible techniques for coping with in-line interference events: frequency isolation and satellite diversity.<sup>70</sup> With satellite diversity, NGSO FSS systems can avoid an in-line interference event by selecting another visible satellite within their system constellation (performing a hand-over process) whenever the current satellite approaches the in-line event with a satellite operating in another NGSO FSS system constellation. Coordinating between themselves, NGSO FSS systems can employ satellite diversity in combination with other available interference mitigation techniques to avoid in-line interference events. With frequency isolation, each satellite operator resorts to a specific portion of the spectrum designated for Ka-Band NGSO FSS. Either method of coping with in-line interference events requires close cooperation of the involved NGSO FSS operators, including, at a minimum, periodic exchanges of ephemeris data. In the *Notice*, the Commission proposed to require frequency isolation in the event that operating systems could not reach a coordination agreement with a new entrant.<sup>71</sup> The comments that addressed the issue support the Commission's default proposal.<sup>72</sup>

45. In order to implement avoidance of in-line interference events in this service, we adopt frequency isolation as the default sharing mechanism by segmenting the shared frequency bands. This default sharing mechanism will be employed from the inception of operations for each system, for all its in-line interference events, unless and until that operator reaches alternative coordination agreements with other operators for use in their respective in-line interference events. We require that operators establish an in-line event spectrum sharing procedure based on the frequency isolation technique. In order for frequency isolation to be employed as the default sharing mechanism, the operators must know which segments of the shared bands will be used. We therefore require that, prior to the launch of its first satellite, each NGSO FSS licensee must complete coordination with all other operational NGSO FSS licensees and with Government FSS systems, and choose its home base spectrum vis a vis every other operational system.<sup>73</sup> This required coordination will segment the entire uplink and downlink spectrum among the operating systems involved in the predicted specific in-line interference event for the duration of the event. During all other times, NGSO FSS systems can operate using the entire designated and licensed NGSO FSS Ku-Band spectrum. More precisely, and taking into account the definition of an in-line interference event that we have adopted, when satellites of different networks reach positions at which the topocentric angle<sup>74</sup> between them is less than 10 degrees, as measured from an operating Earth station, the parties shall split the frequency band equally according to their chosen home base spectrum.

## E. Service Rules

46. The Commission's *Third Report and Order* focused on issues common to both GSO and NGSO systems throughout the Ka-Band, and deferred consideration of issues specific to intra-service sharing among NGSO systems in the Ka-Band. After requesting comment on those issues in this proceeding, we now consider a number of additional service rules that will apply to all Ka-Band NGSO

<sup>70</sup> See ITU-R S.1431. In addition to these two primary mitigation methods, NGSO FSS systems may also be able to employ alternate polarization to avoid in-line interference events.

<sup>71</sup> *Notice*, 17 FCC Rcd at 2816.

<sup>72</sup> SkyBridge Comments at 18; Teledesic Reply at 15; TRW Comments at 7; TRW Reply at 2.

<sup>73</sup> A system is deemed operational when at least one of its satellites reaches its intended orbit and initiates transmission and reception of radio signals.

<sup>74</sup> An angle with its vertex at a point on the surface of the Earth.

FSS licensees. In addition, the Commission recently adopted new licensing procedures to speed delivery of satellite services to consumers.<sup>75</sup> Many of the rules adopted in the *Space Station Reform Order* will apply to applicants in this Ka-Band NGSO FSS, including the elimination of the satellite anti-trafficking rule.

## 1. Financial Qualifications

47. The *Notice* proceeded from the assumption that a spectrum sharing plan could be devised to accommodate all the pending applicants' proposed systems as well as future entry. The Commission consequently did not propose a strict financial qualification standard for applicants in the Ka-Band NGSO FSS. Moreover, in our recent *Space Station Reform Order*, we eliminated the financial qualification requirement from our rules.<sup>76</sup> We found that the requirement was not determinative of whether a space station applicant would proceed with the construction of its system in a timely manner. Instead, to serve the purpose of deterring frivolous or speculative applications, we adopted a bond requirement.<sup>77</sup> All applicants for NGSO FSS Ka-Band licenses will be required to execute a \$7.5 million bond payable to the U.S. Treasury within 30 days of grant of their license, as a condition of their licenses.<sup>78</sup> The bond will be payable upon failure to meet any system construction milestone, including voluntary surrender of licenses before a milestone date. This bond requirement will provide assurance that the Ka-Band licensees are fully committed to constructing their satellite facilities.

## 2. Implementation Milestones

48. In the *Notice*, the Commission proposed that all NGSO FSS Ka-Band licensees would be required to adhere to a strict timetable for system implementation. The Commission proposed implementation milestones that track the schedules recently imposed on other NGSO systems, including a requirement that NGSO FSS licensees enter into a non-contingent satellite manufacturing contract for the system within one year of authorization. The Commission further proposed to require that a licensee complete critical design review<sup>79</sup> within two years of authorization, begin physical construction of all satellites in the system within two and a half years of authorization, and complete construction and launch of the first two satellites within three and a half years of authorization. Each licensed NGSO FSS system would have to be launched and operational within six years of authorization. The Commission proposed to require operators to submit certifications of milestone compliance within 10 days following a milestone specified in their authorization. Alternatively, the Commission proposed tying NGSO FSS licensees to the ITU "Bringing Into Use" date.<sup>80</sup> If that were done, the Commission could require licensees to

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<sup>75</sup> *Space Station Reform Order*, FCC 03-102.

<sup>76</sup> *Id.* at ¶ 164.

<sup>77</sup> *Id.* at ¶ 167-172.

<sup>78</sup> *Id.* at ¶ 168. The amount of this bond is subject to detailed consideration in a further notice of proposed rulemaking.

<sup>79</sup> The critical design review is the stage in the space station implementation process at which the design and development phase ends, and the manufacturing phase begins.

<sup>80</sup> See ITU RR Art. S11.44. Generally, ITU Radio Regulations require that the satellite be "brought-into-use" (BIU) no later than five years from the date the ITU publishes the advance publication information. ITU Radio Regulations Article S11.44. The ITU may extend the BIU date by two years under the conditions specified in ITU Radio Regulations Articles S11.44B through S11.44I (launch failure; launch delays due to circumstances outside the control of the administration or operator; delays caused by modifications of satellite design necessary to reach coordination agreements; problems in meeting the satellite design specifications; delays in reaching coordination after a request for ITU Radiocommunication Bureau assistance; financial circumstances outside the control of the administration or operator; and force majeure).

demonstrate that they are on a launch manifest at a designated time prior to the Bringing Into Use date for this service in the database of the ITU.

49. In the *Third Report and Order*, the Commission adopted a milestone schedule that already applies to GSO FSS and NGSO FSS Ka-Band licensees. In addressing the milestone issues raised in the *Notice*, we therefore decide whether to retain the existing rule, or to modify the milestones schedule applicable to all NGSO FSS Ka-Band licensees.

50. Comments on the issue of milestones were split. @contact and SkyBridge favor linking Commission milestones to the ITU "Bringing Into Use" date, for the sake of harmony between domestic and international deadlines, and in order to preserve the U.S. national interest in priority of this service in these frequencies.<sup>81</sup> Hughes, Teledesic and TRW prefer to maintain our current rule with no changes.<sup>82</sup> Teledesic suggested deferring consideration of any modifications to the current rule to the Commission's *Space Station Reform NPRM*.<sup>83</sup>

51. We do not adopt the alternative proposal to tie our milestones to ITU "Bringing Into Use" dates, because we prefer to preserve the independence of Commission deadlines. ITU "Bringing Into Use" dates occur five to seven years after the ITU publishes advance notification of a new satellite service.<sup>84</sup> In this case, the ITU milestones for bringing these frequencies into use will occur, at the latest, in May 2005. Although the initiation of a new service sometimes requires lengthy spectrum allocation proceedings and processing rounds at the Commission, resulting in milestones that approach or even surpass ITU deadlines, we prefer to retain our flexibility to insist on separate deadlines for U.S. licensees.

52. Because we have adopted the avoidance of in-line interference events method of sharing for this service, no licensee's tardy implementation will hinder the operations of systems that are implemented promptly. Consequently, we do not have one of the warehousing concerns that is typically a motivation for milestones. We are nevertheless obligated to ensure that the public interest in efficient use of spectrum resources is met. NGSO FSS applicants must be prepared to move expeditiously upon licensing or expect to lose their licenses. We will therefore insist on strict adherence to milestones in this service. We are not persuaded by the applicants' comments that modified milestones are intrusive or burdensome on operators.<sup>85</sup> Licensees have successfully met or surpassed our implementation milestones in other bands and other services, and we have no reason to believe that the Ka-Band NGSO FSS licensees cannot perform similarly. Even if these charges were true, however, the unwarranted warehousing of spectrum is itself intrusive and burdensome on other applicants and the public. This burden weighs more heavily in our consideration than that imposed on the NGSO FSS licensees' system implementation plans. We find that an additional milestone for completion of critical design review reflects an accepted business practice in the satellite construction industry, and therefore an observable milestone in the construction of new satellite systems. We also find that the modification to require entry into a non-contingent satellite manufacturing contract is a milestone enforced by the Commission in other satellite services. Requiring commencement of construction on all satellites in the system within two and a half years of license grant is only six months less time than the existing rule.

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<sup>81</sup> @contact Comments at 20; SkyBridge Comments at 20.

<sup>82</sup> Hughes Comments at 27-28; Teledesic Comments at 26.

<sup>83</sup> Teledesic Comments at 26 (citing *Amendment of the Commission's Space Station Licensing Rules and Policies*, Notice of Proposed Rulemaking, IB Docket No. 02-34, 17 FCC Rcd 3847 (2002) ("*Space Station Reform NPRM*").

<sup>84</sup> See *supra* at n. 80.

<sup>85</sup> See Hughes Comments at 29.

53. In our *Space Station Reform Order*, we recently discussed the regulatory philosophy behind our milestones policy, and adopted generic milestones schedules for all satellite services.<sup>86</sup> The generic milestones adopted correspond to the modified milestones schedule proposed in this proceeding. Accordingly, the following generic implementation milestone schedule applies to NGSO FSS systems in the Ka-Band frequencies.

- *One year*: Enter into a binding non-contingent contract to construct the licensed satellite system.
- *Two years*: Complete the critical design review of the licensed satellite system.
- *Two years, six months*: Begin the construction of the first two satellites in the licensed satellite system.
- *Three years, six months*: Launch and operate the first two satellites in the licensed satellite system.
- *Six years*: Bring all the satellites in the licensed satellite system into operation.

These milestones will be incorporated as conditions in all NGSO FSS licenses.<sup>87</sup> Non-compliance with implementation milestones will result in cancellation of the authorization and loss of the performance bond. Licensees must submit certifications of milestone compliance within 10 days following each milestone specified in their authorization. Failure to file a timely certification of milestone compliance, or filing disclosure of non-compliance, will result in automatic cancellation of an operator's system authorization with no further action required on the Commission's part.

### 3. Reporting Requirements

54. The *Notice* proposed to apply to the NGSO FSS a slight variation of the Part 25 rules governing reporting requirements for Ka-Band FSS systems. Ka-Band FSS licensees are required to file, on June 30 of each year, an annual report with the Commission describing: the status of satellite construction and anticipated launch dates, including any major delays or problems encountered; a listing of any non-scheduled space station outages; and an identification of space stations unavailable for service.<sup>88</sup> Any anticipated delay in these schedules requires a request for an extension of time. The commenters generally support our proposed reporting requirements. Only @contact supports its proposal to require quarterly reports; most of the other applicants oppose more frequent reporting.<sup>89</sup> Because we find that quadrupling the number of reports is unlikely to provide sufficient benefit to outweigh the additional burden on licensees and staff, we do not adopt @contact's proposal for quarterly reports.

### 4. Orbital Debris Mitigation

55. In the *Notice*, we proposed to adopt a requirement that NGSO FSS applicants disclose their orbital debris mitigation plans. Orbital debris and related mitigation measures could affect the cost, reliability, and safety of satellite operations, thus affecting the larger and more effective use of radio in

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<sup>86</sup> *Space Station Reform Order*, at ¶¶ 173-208.

<sup>87</sup> See *Space Station Reform NPRM*, 17 FCC Rcd at 3882.

<sup>88</sup> See 47 C.F.R. § 25.145(g).

<sup>89</sup> @contact Comments at 20; Hughes Comments at 31; Teledesic Comments at 22; TRW Comments at 20.

the public interest.<sup>90</sup> Commenters support this requirement, which is generally applicable to all satellite services.<sup>91</sup> Consistent with our recent practice in other satellite services, we find in this case that it is in the public interest to require NGSO FSS applicants to disclose their orbital debris mitigation plans before licensing.<sup>92</sup> In their conforming amendments, applicants must submit a narrative statement describing the debris mitigation design and operational strategies, if any, that they will use. Applicants are specifically required to submit a casualty risk assessment if planned post-mission disposal involves atmospheric re-entry of the spacecraft. In preparing such exhibits, applicants may find guidance in the U.S. Government Orbital Debris Mitigation Standard Practices.<sup>93</sup> The Commission has initiated a rulemaking proceeding to address orbital debris issues concerning Commission space station licenses. Among other things, this rulemaking proposes to require disclosure of debris mitigation plans by all satellite systems providing service to the United States.<sup>94</sup>

## 5. System License and License Terms

56. The *Notice* proposed to authorize Ka-Band NGSO FSS space stations under blanket licenses for constellations of technically identical satellites that may be launched and retired at different times, a licensing approach previously applied to a number of other NGSO services. The commenters generally support this proposal. We therefore adopt our proposals for system license and license terms. NGSO FSS authorizations will cover all construction and launches necessary to implement the complete constellation and to maintain it until the end of the license term, including any replacement satellites necessitated by launch or operational failure, or by retirement of satellites prior to the end of the license period. All replacement satellites must be technically identical to those in service, including the same frequency bands and orbital parameters, and may not cause a net increase in the number of operating satellites in the authorized orbital planes or an additional orbital plane. The license term will run from the date on which the first space station in the system begins transmitting and receiving radio signals, and be valid for fifteen years from that point in time.<sup>95</sup> The filing window for system replacement applications prior to the expiration of the license must be sufficient to allow adequate time for the Commission to act upon system replacement applications. System replacement applications must be filed no earlier than three months prior to the end of the twelfth year of the existing system license, and no later than one month after the end of the twelfth year.<sup>96</sup> This filing deadline is three years in advance of the system license expiration, in order to give the licensee and the Commission ample time to consider the replacement request.

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<sup>90</sup> *In the Matter of Mitigation of Orbital Debris*, Notice of Proposed Rulemaking, FCC No. 02-80, 17 FCC Rcd 5586, 5599 (2002) (citing 47 U.S.C. § 303(g)).

<sup>91</sup> @contact Comments at 21; SkyBridge Comments at 20; Teledesic Comments at 27.

<sup>92</sup> *The Establishment of Policies and Service Rules for the Mobile Satellite Service in the 2 GHz Band*, Report and Order, 15 FCC Rcd 16127, 16188.

<sup>93</sup> <http://orbitaldebris.jsc.nasa.gov/mitigate/mitigation.html>. See also National Aeronautics and Space Administration Safety Standard 1740.14, <http://orbitaldebris.jsc.nasa.gov/mitigate/nss1740/nss1740.html>. See also, *In The Matter Of Application Of Constellation Communications Holdings, Inc.*, Order and Authorization, 16 FCC Rcd 13724, 13731 (Int'l Bur. and Office of Eng. and Tech. 2001); *In The Matter Of Application Of The Boeing Company*, Order and Authorization, 16 FCC Rcd 13691, 13702 (Int'l Bur. 2001).

<sup>94</sup> *In the Matter of Mitigation of Orbital Debris*, Notice of Proposed Rulemaking, FCC No. 02-80, 17 FCC Rcd 5586 (2002).

<sup>95</sup> See *Space Station Reform NPRM*, 17 FCC Rcd at 3894. The Commission adopted a rule revision that enables it to issue satellite licenses with 15 years terms, rather than the 10-year license terms previously authorized. The rule revision for 15-year terms applies to all space station and earth station licenses granted after the effective date of the rule change, April 18, 2002. 67 Fed. Reg. 12485 (March 19, 2002).

<sup>96</sup> *Space Station Reform Order* at ¶ 267.

#### IV. CONCLUSION

57. This *Report and Order* allows deployment of Ka-Band NGSO FSS in the United States, by establishing a spectrum sharing plan among Ka-Band NGSO FSS applicants, and service rules for implementation of these systems. The decisions adopted in this Order are also consistent with the Commission's decisions in the recently adopted *Space Station Reform Order*. We believe that the avoidance of in-line interference events sharing plan that we have adopted is sufficiently flexible to accommodate all of the NGSO FSS systems put forth by the pending applicants, as well as the possible future systems. Our action today permits these proposed systems to provide consumers with yet another option for access to competitive broadband voice and data services, which will benefit the public interest by promoting innovative new services at competitive prices.

#### V. PROCEDURAL INFORMATION

##### Final Regulatory Flexibility Certification

58. *Final Regulatory Flexibility Certification.* The certification regarding this *Report and Order*, pursuant to the Regulatory Flexibility Act of 1980, *see* 5 U.S.C. Section 604, is contained in Appendix C.

##### Further Information

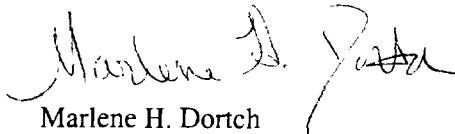
59. For further information concerning this *Report and Order*, contact: J. Mark Young at (202) 418-0762, Internet address: [mark.young@fcc.gov](mailto:mark.young@fcc.gov), or Kal Krautkramer at (202) 418-1335, Internet address: [kal.krautkramer@fcc.gov](mailto:kal.krautkramer@fcc.gov), International Bureau, Federal Communications Commission, Washington, DC 20554.

#### VI. ORDERING CLAUSES

60. IT IS ORDERED that, pursuant to Sections 4(i), 7(a), 303(c), 303(f), 303(g), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 157(a), 303(c), 303(f), 303(g), and 303(r), this *Report and Order* is hereby ADOPTED.

61. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this *Report and Order*, including the Final Regulatory Flexibility Certification, in a report to Congress pursuant to the Congressional Review Act, *see* 5 U.S.C. § 801(a)(1)(A); and shall also send a copy of this *Report and Order*, including the Final Regulatory Flexibility Certification, to the Chief Counsel for Advocacy of the Small Business Administration. *See* 5 U.S.C. § 605(b). A copy of this *Report and Order*, including the Final Regulatory Flexibility Certification, will be published in the Federal Register. *See* 5 U.S.C. § 605(b).

FEDERAL COMMUNICATIONS COMMISSION

  
Marlene H. Dortch  
Secretary

**APPENDIX A**  
**LIST OF PARTIES**

**Comments**

@contact LLC  
Hughes Communications, Inc.  
SkyBridge L.L.C.  
Teledesic LLC  
TRW, Inc.

**Reply Comments**

@contact LLC  
Hughes Communications, Inc.  
SkyBridge L.L.C.  
Teledesic LLC  
TRW, Inc.

## APPENDIX B: Final Rules

For the reasons set forth in the preamble, part 25 of title 47 of the Code of Federal Regulations is amended as follows:

### PART 25-SATELLITE COMMUNICATIONS

The authority citation for Part 25 continues to read as follows:

**AUTHORITY:** 47 U.S.C. 701-744. Interprets or applies Sections 4, 301, 302, 303, 307, 309 and 332 of the Communications Act, as amended, 47 U.S.C. Sections 154, 301, 302, 303, 307, 309 and 332, unless otherwise noted.

1. Section 25.145 is amended by adding or modifying the following paragraphs (c)(3), (f), (g), (j), (k), and (l):

#### **§ 25.145 Licensing conditions for the Fixed-Satellite Service in the 20/30 GHz bands.**

(c) \* \* \* \* \*

- (3) A description of the design and operational strategies that it will use, if any, to mitigate orbital debris. Each applicant must submit a casualty risk assessment if planned post-mission disposal involves atmospheric re-entry of the spacecraft.

(f) **deleted**

(g) Reporting Requirements:

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(iv) All operators of NGSO FSS systems in the 18.8-19.3 GHz and 28.6-29.1 GHz bands shall, within 10 days after a required implementation milestone as specified in the system authorization, certify to the Commission by affidavit that the milestone has been met or notify the Commission by letter that it has not been met. At its discretion, the Commission may require the submission of additional information (supported by affidavit of a person or persons with knowledge thereof) to demonstrate that the milestone has been met. Failure to file a timely certification of milestones, or filing disclosure of non-compliance, will result in automatic cancellation of the authorization with no further action required on the Commission's part.

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(j) **Replacement of Space Stations within the System License Term.** Licensees of NGSO FSS systems in the 18.8-19.3 GHz and 28.6-29.1 GHz frequency bands authorized through a blanket license pursuant to paragraph (b) of this section need not file separate applications to launch and operate technically identical replacement satellites within the term of the system authorization. However, the licensee shall certify to the Commission, at least thirty days prior to launch of such replacement(s) that:

- (1) The licensee intends to launch a space station into the previously-authorized orbit that is technically identical to those authorized in its system authorization and

- (2) Launch of this space station will not cause the licensee to exceed the total number of operating space stations authorized by the Commission.
- (k) **In-Orbit Spares.** Licensees need not file separate applications to operate technically identical in-orbit spares authorized as part of the blanket license pursuant to paragraph (b) of this section. However, the licensee shall certify to the Commission, within 10 days of bringing the in-orbit spare into operation, that operation of this space station did not cause the licensee to exceed the total number of operating space stations authorized by the Commission.

2. New Section 25.261 is adopted.

**Section 25.261 Procedures for Avoidance of In-line Interference Events for Non Geostationary Satellite Orbit (NGSO) Satellite Network Operations in the Fixed Satellite Service (FSS) Bands.**

(a) *Applicable NGSO FSS Bands.* The coordination procedures in this section apply to non-Federal-Government NGSO FSS satellite networks operating in the following assigned frequency bands:

- (i) the 28.6-29.1 GHz or 18.8-19.3 GHz frequency bands.

(b) *Definition of "In-Line Interference Events."* For purposes of this section, an "in-line interference event" is defined as the interference associated with an occurrence of any physical alignment of space stations of two or more satellite networks with an operating Earth station of one of these networks in such a way that the angular separation between operational links of the two networks is less than 10° as measured at the Earth station.

(c) *Default Procedure.* If no agreed coordination exists between two or more satellite networks, then the bands will be divided among the affected satellite networks involved in an in-line interference event in accordance with the following procedure:

- i. each of  $n$  (number of) satellite networks involved in a particular in-line interference event shall select  $1/n$  of the assigned spectrum available in each frequency band for its home base spectrum. The selection order for each satellite network shall be determined by and be in accordance with the date that the first space station in each satellite network is launched and operating;
- ii. the affected space station(s) of the respective satellite networks shall only operate in the selected ( $1/n$ ) spectrum associated with its satellite network, its home base spectrum, for the duration of the in-line interference event;
- iii. all affected space station(s) may resume operations throughout the assigned frequency bands once the angular separation between the affected space stations in the in-line interference event is again greater than 10°.

(d) *Coordination Procedure.* Any coordination procedure agreed among the affected operating satellite networks, which allows operations of the satellite networks when each network's respective space stations are within the 10 degree avoidance angle associated with an in-line interference event, shall supersede the default procedure of subsection (c). Coordination may be effected using information relating to the space stations and the parameters of one or more typical earth stations. All parties are required to coordinate in good faith.

**APPENDIX C: FINAL REGULATORY FLEXIBILITY CERTIFICATION**

The Regulatory Flexibility Act of 1980, as amended (RFA),<sup>1</sup> requires that a regulatory flexibility analysis be prepared for notice and comment rulemaking proceedings, unless the agency certifies that "the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities."<sup>2</sup> The RFA generally defines "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."<sup>3</sup> In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.<sup>4</sup> A small business concern is one which: (a) is independently owned and operated; (b) is not dominant in its field of operation; and (c) satisfies any additional criteria established by the Small Business Administration (SBA).<sup>5</sup>

The objective of the *Report and Order* and of this proceeding is to assign the NGSO FSS spectrum to satellite systems operators who can implement their proposals in a manner that serves the public interest. The final rules in the *Report and Order* will reduce regulatory burdens and, with minimal disruption to existing FCC permittees and licensees, result in the continued development of NGSO FSS and other satellite services to the public.

Neither the Commission nor the U.S. Small Business Administration has developed a small business size standard specifically for NGSO FSS licensees. The appropriate size standard is therefore the SBA standard for Satellite Telecommunications, which provides that such entities are small if they have \$12.5 million or less in annual revenues.<sup>6</sup>

The rules adopted in this *Report and Order* apply only to entities providing NGSO FSS. Small businesses will not have the financial ability to become NGSO FSS system operators because of the high implementation costs, including construction of satellite space stations and rocket launch, associated with satellite systems and services.<sup>7</sup> Since the spectrum and orbital resources available for assignment are not open to new entrants, we estimate that only the four applicants whose applications are pending will be authorized by the Commission to provide these services. None of the seven applicants is a small business because each has revenues in excess of \$12.5 million annually or has parent companies or investors that have revenues in excess of \$12.5 million annually.<sup>8</sup>

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<sup>1</sup> See 5 U.S.C. § 603. The RFA, 5 U.S.C. § 601- 612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA. Pub. L. No. 104-121, 110 Stat. 857 (1996)).

<sup>2</sup> 5 U.S.C § 605(b).

<sup>3</sup> *Id.* at § 601(6).

<sup>4</sup> *Id.* at § 601(3) (incorporating by reference the definition of "small business concern" in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies "unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register."

<sup>5</sup> Small Business Act, 15 U.S.C. § 632.

<sup>6</sup> 13 C.F.R. § 121.201, North American Industry Classification System ("NAICS") code 517410.

<sup>7</sup> See, e.g., *Final Analysis Communication Services, Inc.*, 13 FCC Rcd 6618, 6644 (1998) (non-geostationary satellite applicant estimated that "cost of construction, launch and first-year operating costs for two satellites was approximately \$6.22 million").

<sup>8</sup> 13 C.F.R. § 121.201, North American Industry Classification System ("NAICS") code 517410.

Therefore, we certify that the rules adopted in this *Report and Order* will not have a significant economic impact on a substantial number of small entities. The Commission will send a copy of this *Report and Order*, including this Final Regulatory Flexibility Certification, in a report to Congress pursuant to the Congressional Review Act.<sup>9</sup> In addition, the *Report and Order* and this final certification will be sent to the Chief Counsel for Advocacy of the Small Business Administration, and will be published in the Federal Register.<sup>10</sup>

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<sup>9</sup> See 5 U.S.C. § 801(a)(1)(A).

<sup>10</sup> See 5 U.S.C. § 605(b).